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Oversight News

Newsletter of the Commonwealth's Environmental Oversight of the Paducah Gaseous Diffusion Plant

Installation of Six-Phase Heating System Begins

Installation of a promising technology that uses electricity to heat TCE-contaminated soils is under way at the Paducah Gaseous Diffusion Plant (PGDP). The technology, six-phase heating, will be tested near the plant's C-400 building, perhaps as early as December 2002. Six-phase heating has been used successfully at many sites around the country to remove trichloroethene (TCE) and other dense non-aqueous phase liquids (DNAPL) from soils, which prevents continued seepage of this contamination into the groundwater.

DNAPL contaminants are a serious problem at many industrial sites nationwide. The acronym "DNAPL" refers to the fact that they are denser than and only slightly soluble in water. Because of such traits, DNAPL tends to sink deep into groundwater aquifers and pool as a virtually undiluted mass. Once at the bottom of an aquifer, these liquids are hard to capture and can act as an ongoing source of groundwater contamination.

Six-phase heating requires the installation of at least seven underground electrodes. Six of the electrodes are installed in a hexagonal array to a desired depth in the contaminated soils. As electricity flows between the six hexagonally arranged electrodes and the seventh electrode, TCE-contaminated soil and groundwater are heated, which causes the TCE to vaporize. Vacuum wells extract the vapor, which is then treated before being discharged into the atmosphere. In some cases, six-phase heating has been more than 90 percent effective at removing DNAPL from the subsurface. It also has the advantage of being able to remediate contaminated soils in a relatively short period of time—a few years.

Installation of the six-phase system at Paducah began in early April 2002. CDM Federal, the prime contractor for this study, is working closely with Thermal Remediation Services, the technology vendor, to complete the installation. At the outset of the project, there was considerable concern that it would be difficult to drill near the C-400 building due to the dense array of underground utilities in the area. But so far the installation has been relatively smooth. At press time, two of the seven electrodes had been installed. Installation of a third electrode was suspended due to safety concerns but will resume shortly. Six of 15 piezometers and three of four multi-port wells have also been installed.

(continued on page 5)

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In this issue

New Equipment Gets the Lowdown on Groundwater Wells

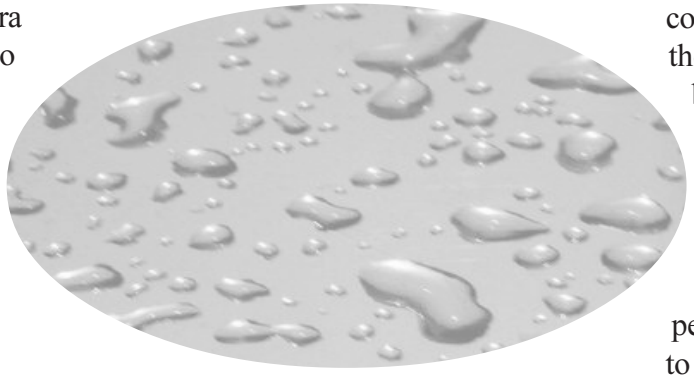
Kentucky's newest inspector will be able to go where no person has ever gone before: inside residential water wells north of the Paducah Gaseous Diffusion Plant.

The "inspector" is a down-hole video camera purchased by Kentucky's Agreement in Principle (AIP) program. The camera, specially designed for lowering down slender shafts, is waterproof and has 300 feet of cable. Hooked up to a video monitor, the camera allows personnel to go on a virtual inspection in real time.

Although the cylindrical camera fits into wells as narrow as two inches in diameter, its output won't seem like tunnel vision. The camera will provide a 360-degree view of well casing interiors. It records in color, which is key when it comes to identifying rust, bacterial growth and other problems.

AIP personnel will use the camera to check the condition of a number of residential wells currently sampled by DOE and Kentucky. Many of these wells were installed several decades ago using unknown construction practices. Over time the residential wells may have deteriorated with age or lack of upkeep. Corrosion may have caused holes, cracks or leaks that allow surface water from the immediate area to enter the well, bringing surface contamination with it that may have no relation to PGDP activities. Bacterial growth may affect the chemistry of the water samples collected from the wells. Sediment may clog portions of the well.

These problems with a well's integrity can affect the accuracy of sample results. Accurate information is critical to the ability to adequately monitor areas where contaminated groundwater is approaching water supply wells. It is also essential if project managers are to understand groundwater and



contaminant movement in the region. If a well is in poor condition, the state may decide to discontinue sampling it in favor of a nearby well in better condition.

The camera will also allow the AIP program to locate the depth of each well's screened interval. A well's screen is a slotted area in an otherwise solid casing that allows groundwater to pass through. By knowing the depth of the groundwater passing through a well, geologists can better identify the aquifer that is the source of the water entering the well. They may also be able to compare the data collected from the residential well to data collected from the same "horizon," or depth interval, closer to the PGDP.

AIP personnel will also use the camera to check several monitoring wells installed by DOE. Two years ago, corrosion was found in monitoring wells DOE had installed around three solid waste landfills at the PGDP. While those wells have been replaced, Kentucky plans to check a number of DOE's off-site wells for any possible corrosion. Kentucky will also use the camera to make sure that the bladder pumps (used to pump water to the surface during sampling) in these wells are properly positioned.

The camera may also help AIP personnel decide at what depths to place new sampling devices called passive diffusion bag samplers. Kentucky plans to use these samplers to collect groundwater from multiple depths in some monitoring and residential wells. The results will help investigate whether different levels of contamination exist at different groundwater depths (for more information, see a related article on page 4 of the April 2002 issue of Oversight News).

The video camera will be cleaned each time after it is used in one well before moving on to the next well. Proper decontamination of

Residential Wells under Scrutiny

Collecting a water sample from an underground well is easy. The hard part is making sure that the groundwater sample taken from inside the well is the same as the groundwater outside the well.

Monitoring wells have a precise set of standards for construction – designed to ensure that samples collected from a monitoring well do reflect the surrounding groundwater conditions. They must be inspected and maintained to ensure they continue to meet these standards.

Many residential wells, on the other hand, were built decades ago using undocumented construction practices. These wells may not have undergone regular maintenance. If a well's condition has deteriorated, it may be highly unsuitable for environmental monitoring purposes. Corrosion, cracks in the well casing that allow surface water to enter, or bacterial growth can affect the chemistry of the groundwater inside the well, so that the lab results do not give reliable information about groundwater conditions outside the well.

Beneath the Paducah Gaseous Diffusion Plant (PGDP), groundwater flows continuously towards the Ohio River. In August 1988, officials from several agencies sampled residential water supply wells near the DOE property. Groundwater from four wells had trichloroethene (TCE) levels above the maximum level allowed under the Safe Drinking Water Act. Before August 1988, residents living around the PGDP relied solely on groundwater to supply their agricultural and residential water needs. As a result of the discovery, the Department of Energy provided the affected residents with a temporary water supply.

DOE began using residential wells to investigate the impact of contamination on groundwater surrounding the PGDP. The residential wells were sampled out of necessity, because no monitoring wells existed in the residential areas.

The top priority of the initial groundwater sampling was to

safeguard residents from drinking, coming into contact with, or inhaling vapors from contaminated groundwater. DOE used information from the sampling events to create an area where residential well usage is restricted. The area DOE defined, known as the Water Policy Box, is still in use today.

More than a decade after the discovery of groundwater contamination, many residential wells are still being used to monitor groundwater conditions. Monitoring wells remain scarce in some areas of the Water Policy Box.

Kentucky is especially concerned with the eastern portion of the Water Policy Box, bounded mainly by Metropolis Lake Road. Only two DOE-installed monitoring wells are being sampled along the eastern portion of the Water Policy Box. DOE currently has no monitoring wells east of Metropolis Lake Road, an area where several households still use groundwater wells for their water supply. For several years the TCE-laden Northeast Plume has been close to breaching the

New Equipment

(continued from page 2)

the camera will ensure that any contaminant present in one well will not be transferred to any other wells. The camera will not be used in any wells that have radiological contamination.

By **Brian Begley** *and* **Lauren McDonald**, *Ky. Division of Waste Management, Hazardous Waste Branch*

Deer Harvest

(continued from page 5)

Kidney, liver and muscle tissues were analyzed for metals. Although many of the metals were found at similar levels in deer from both locations, five of the metals detected in the muscle tissue of WKWMA deer—antimony, barium, selenium, silver and vanadium—were not found in the muscle tissue of the Stewart Island deer.

Radionuclides were detected in samples from four of the five WKWMA deer. Uranium-234 was detected in two bone samples and one liver sample. Uranium-235 was detected in one bone sample, as was Uranium-238. No radionuclides were detected in the Stewart Island deer.

The three uranium isotopes (U-234, U-235 and U-238) are naturally occurring, U-238 being the most common. U-235 and U-234 make up less than 1 percent of the naturally occurring uranium. U-235, the fissionable isotope, is the form enriched at the PGDP.

The only other radionuclide detected, thorium-230, was found in two bone samples, one liver sample and one muscle sample. Thorium-230 is the naturally occurring decay product of uranium-234.

Still to be conducted is a PCB dose risk assessment. Using the highest PCB value detected (0.057 ppm), the risk assessment will help evaluate how safe it is to eat meat from WKWMA deer. Last year the risk assessment concluded that the risk to the hunter who eats 100 pounds of the two deer that had the highest PCB levels (0.145 ppm) would have an average increased cancer risk of four in a million.

By **Janet Miller**, *Ky. Division of Waste Management, Hazardous Waste Branch*

Residential Wells

(continued from page 3)

eastern edge (Metropolis Lake Road) of the Water Policy Box.

Little is known about the condition or structure of these residential wells, but that is about to change. Kentucky's Agreement in Principle program will begin using a down-hole camera to inspect residential wells (see related article on page 2). This information can then be used to determine the need for additional monitoring wells.

By **Brian Begley**, *Ky. Division of Waste Management, Hazardous Waste Branch*

The new storm water collection basin is in operation in the north-west corner of the Paducah Gaseous Diffusion Plant property. The basin collects rainfall that runs off scrap metal yards in the area and picks up potentially contaminated sediments. By allowing the sediments to settle out of the storm water, the basin limits the flow of contaminants into Bayou Creek nearby.
Photo by **Gaye Brewer**, *Ky. Division of Waste Management*

Six Phase Installation

(continued from page 1)

It's hoped that the six-phase treatability study will demonstrate the viability of using this technology at the PGDP. The system will be tested within the relatively shallow Upper Continental soils directly beneath the C-400 building, and within the Regional Gravel Aquifer. While the technology is expected to perform reasonably well in the shallower (Upper Continental) deposits, it's unknown whether six-phase will be effective at removing DNAPL from the Regional Gravel Aquifer. If all goes as planned, answers to these and other questions should become evident during first few months of 2003. The Kentucky Division of Waste Management is optimistic that six-phase heating will prove to be a valuable tool for use at C-400 and at other similarly contaminated areas at the PGDP.

By **Todd Mullins**, *Ky. Division of Waste Management, Hazardous Waste Branch*

Deer Harvest Conducted

DOE has released preliminary results from the July 2002 deer harvest at the West Kentucky Wildlife Management Area (WKWMA). The Energy Department conducts the event annually to help communicate possible risks to hunters and others who may eat deer from the property surrounding the Paducah Gaseous Diffusion Plant (PGDP).

Lab testing shows polychlorinated biphenyl (PCB) levels of 0.018-0.057 parts per million (ppm), which are well below the federal Food and Drug Administration's action limit for red meat, 3.0 ppm. Last year's PCB levels were 0.009-0.145 ppm.

PCBs are a widespread contaminant and, not surprisingly, were also detected in the "background" deer at a level of 0.034 ppm. Comparing results from WKWMA deer with those from deer at a background site in the region helps analysts isolate any possible effects from industrial facilities in the immediate area of the WKWMA. These facilities include the PGDP, the TVA Shawnee Steam Plant and the Joppa, Ill., power plant.

This year the background deer was collected at a site upriver of the WKWMA, rather than at the Ballard County Wildlife Management Area, a downriver location used in past years. The background site was Stewart Island, a 400-acre Livingston County reserve upstream from the Smithland Lock and Dam.

(continued on page 4)

Facility D&D Update

DOE and Kentucky are moving forward with plans to remove materials and equipment (*i.e.*, infrastructure) from inside the C-410 complex, a group of buildings and related facilities once used to produce uranium hexafluoride feedstock for the Paducah Gaseous Diffusion Plant cascades. All of these structures are generally in a state of disrepair and pose potential risks to plant workers and the general public if they remain in their current condition. Kentucky is working closely with DOE to ensure that the operation, called "decontamination and decommissioning," or "D&D," is performed in a safe and effective manner.

DOE has only a few minor issues to address before on-site work may begin. The Kentucky Division of Waste Management and the U.S. EPA approved the Action Memo in July 2002. Kentucky issued comments on DOE's first draft of the Removal Action Work Plan in August and expects to approve the final version in October. At that point DOE will be cleared to start

(continued on page 6)

Natural Resources and Environmental Protection Cabinet
Department for Environmental Protection
Division of Waste Management
Hazardous Waste Branch
14 Reilly Road
Frankfort, KY 40601

D&D

(continued from page 5)

removing C-410 infrastructure. DOE will explore options for the structures' final disposition as a separate action.

Since this action will take place over several years, state and federal regulators expect DOE to submit regular progress reports. Future issues of Oversight News will include updates on the project.

By **Todd Mullins**, *Ky. Division of Waste Management, Hazardous Waste Branch*

The ***Kentucky Environmental Oversight News*** is published quarterly by the Kentucky Department for Environmental Protection's Division of Waste Management. It features information regarding environmental remediation activities at the Paducah Gaseous Diffusion Plant site and related topics. Subscriptions are free and may be requested from Lauren McDonald (newsletter editor), Hazardous Waste Branch, Division of Waste Management, 14 Reilly Road, Frankfort, KY 40601 (502) 564-6716, FAX (502) 564-2705.

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For more information:
Contact Gaye Brewer
Division of Waste Management
P.O. Box 1410, Bldg. C-103
West Paducah, KY 42086
(270) 441-5278
FAX (270) 441-5277

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